DOE F 1325.B
(8-89)
EFG (07-90)

United States Government **Department of Energy**

memorandum

DATE: January 15, 1998

REPLY TO ATTN OF: Air, Water and Radiation Division

SUBJECT: Planned Revisions to National Primary Drinking Water Standards

TO: Distribution

We wish to provide you with an update of plans by the Environmental Protection Agency (EPA) to issue final revisions to the national primary drinking water standards for radionuclides (40 CFR 141). If implemented, EPA's planned approach will impact DOE's radioactive waste management and environmental restoration programs. EPA announced these plans at a December 1997 Radionuclides Stakeholders Meeting (see attachment).

Existing regulations (issued in 1976) include for beta-gamma emitters a four-millirem (dose equivalent) limit that is applicable to each organ and the whole body, as well as maximum contaminant limits (MCLs) for radium isotopes and for total alpha activity. Also, the rule sets forth MCLs for tritium and strontium-90, as well as instructions for calculating MCLs for other beta-gamma emitters. Then in 1991, EPA proposed revised drinking water standards that included an annual four-millirem effective dose equivalent (ede) limit for beta-gamma emitters, and corresponding radionuclide-specific MCLs that were generally much larger than existing MCLs. EPA also proposed larger MCLs for radium isotopes, and MCLs for uranium isotopes and for radon. But the 1991 proposed rule was not promulgated. EPA now plans to issue final standards for all radionuclides (except for radon, which will be considered later) by November 2000 (and possibly as soon as January 1999).

For the final rule, EPA may eliminate the four-millirem (ede) limit for beta-gamma emitters. Instead, EPA is considering promulgating specific MCLs for each radionuclide that would be the same as, or smaller than, existing MCLs. These MCLs would correspond to smaller annual doses than four millirem (ede). For example, the likely final MCLs for tritium, I-129, and Ni-63 would correspond to annual doses Of 1.3, 0.2, and 0.02 millirem (ede), respectively. In addition, EPA may eliminate the 15-pCi/L limit for total alpha activity, and issue separate MCLs for each alpha-emitting radionuclide. The final MCL for radium may be similar to the existing standard (5 pCi/L for combined Ra-226 and Ra-228). The final MCLs for uranium may be somewhat more restrictive than those proposed in 1991.

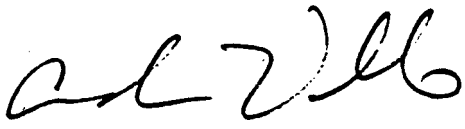
In issuing final MCLs, EPA plans to consider the feasibility, including costs, of treating for contaminants in large drinking

water system, but not the costs of applying drinking water MCLs to other applications. Nonetheless, EPA plans to continue its policy of linking groundwater protection requirements to drinking water MCLs. EPA will also comply with the requirement in the Safe Drinking Water Act (as amended) to review and revise, if necessary, drinking water requirements not less often than every six years.

The Department's environmental restoration and radioactive waste disposal programs will probably be affected. Where drinking water MCLs are applied as standards for remediation of ground water, remediation efforts could become more costly and extensive, and at present we have no data to determine whether there would be any enhanced health benefits. Additional efforts might be required at sites where remediation based on existing MCLs had been completed.

In addition, performance assessments for DOE low-level radioactive waste disposal facilities address ground water protection. Although not required to do so by DOE requirement, analysts have used EPA drinking water requirements as ground water protection performance measures. It has been assumed that application of EPA's proposed (1991) four-millirem (ede) dose limit to hypothetical exposures through ground water would adequately represent future drinking water requirements. Under EPA'S interpretation of the law and their approach for setting drinking water standards, this assumption would be incorrect.

To develop a position on this standard the Department needs to assess its possible benefits and costs, and its implications on DOE programs and resources. We plan to contact many of you to request help in obtaining data needed to develop such a DOE position. (However, if you currently have data or input related to the revisions EPA is considering, please contact my staff at your earliest convenience.) We will continue to monitor EPA's development of revised drinking water standards, and will., provide additional information when it is available. Questions may be directed to E. Regnier (202-586-5027), J. Bachmaier (202-586-0341) or G. Roles (202-586-0289).



Andrew Wallo III, Director
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cc: **Other Organizations**

National Low-Level Waste Management Program, EG&G Idaho
Hazardous Waste Remedial Action Program, (HAZWRAP)
Remedial Action Program Information Center
Center for Environmental Management Information

SUMMARY OF EPA RADIONUCLIDES STAKEHOLDER MEETING

On 11-12 December 1997, EPA held a "stakeholders meeting" in Arlington, VA to provide information on the progress of EPA's development of revised regulations for radionuclides in drinking water (40 CFR 141) and to briefly solicit the views of interested parties. EPA is under court order to issue a final rule by November 2000. Of particular interest were discussions of several policies, analytical techniques, and statutory interpretations, all of which will result in a lowering of the existing MCLs. (Copies of meeting handouts are available upon request from EH-41.)

- 0 A provision of the Safe Drinking Water Act Amendments of 1996 (SDWA) states that any revision of a primary drinking water regulation shall maintain, or provide for greater, protection of the health of persons. Although this provision could be interpreted to mean that the risk level intended to be achieved by the original regulation should be maintained in the revision, EPA interprets it to mean that the risk level actually achieved by the regulation cannot be raised, but can only be reduced. Further, EPA applies this interpretation to each individual radionuclide, and not, for example, to the risk from all beta-gamma emitters combined.

  Instead of specifying an annual 4-mrem (ede) dose limit for all beta-gamma emitters, EPA now plans to specify concentration limits for a list of radionuclides. Current data indicate that some radionuclides present smaller risks and others larger risks than believed in 1976 when the regulation was issued. For those with larger risks, the MCL will be lowered. For those with lower risks, the MCL will remain unchanged.

- 0 EPA plans to base the MCLs on both mortality and morbidity risks (as proposed in 1991) instead of on mortality risks only (as was done in the current regulation and is standard radiation protection practice). The risk limit for morbidity ($1x10^{-4}$) would be twice the risk limit for mortality ($5x10^{-5}$). Thus, for radionuclides for which the risk of death is greater than 50% of the risk of disease, the MCL will be lowered. For the converse situation, the MCL will not be raised.

'Section '1412(b)(9): "The Administrator shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation promulgated under this title. Any revision of a national primary drinking water regulation shall be promulgated in accordance with this section, except that each revision shall maintain, or provide for greater, protection of the health of persons."

- 0 The EPA is also now factoring in risk conversion factors for children and other sensitive subpopulations, which may lower the MCLs somewhat.

- 0 In changing from whole body and organ dose limits to the effective dose equivalent system EPA is making assumptions (based on simplistic analyses) which result in the conclusion that, for numerically equivalent limits, an ede limit results in a higher risk than the previous whole body and organ limit.

EPA is giving little consideration to costs for the revised standard:

- 0 EPA assumes that maintaining the risk levels actually achieved by the current MCLs is zero cost using the rationale that existing water treatment systems either have, or should have, installed treatment equipment sufficient to meet the current standards. This ignores the costs of operation and maintenance, costs for new water supply systems, and costs for the systems constructed in accordance with the proposed regulations.

- 0 EPA is not considering the costs of applying the standards to ground water for CERCLA cleanups, for no-migration petitions, and for radioactive waste disposal sites. At the same time EPA asserts that law and EPA policy mandates the application of drinking water MCL's in these circumstances and thus will consider neither costs nor benefits in promulgating the relevant regulations.

- 0 EPA interprets the SDWA amendment of 1996 as prohibiting them from considering costs in the revision of previously issued standards.

- 0 EPA is not including radon in this rule. Congress intervened to halt the issuance of the 1991 proposed rule because the costs of implementing the radon standard were viewed as excessive. This was 'the case even though the risk levels that would have been permitted for radon were much higher than the risk levels proposed for beta-gamma emitters. EPA plans to promulgate radon standards later.

Forecasts of Maximum Contaminant Limits (MCLs) for Radionuclides in Drinking Water

As issued in 1976, requirements in 40 CFR 141 for radionuclides include a four-millirem (dose equivalent) limit for beta-gamma emitters, MCLs for H-3 and Sr-90, and MCLs for radium isotopes and total alpha activity. Also, the rule sets forth instructions for calculating MCLs corresponding to the four-millirem (mrem) limit for other beta-gamma emitters. Then in 1991, EPA proposed revised drinking water standards that include an annual four-mrem effective dose equivalent (ede) limit for beta-gamma emitters, and corresponding radionuclide-specific MCLs that are generally larger than existing MCLs. EPA also proposed larger MCLs for radium isotopes, and MCLs for uranium isotopes and for radon (56 FR 33050, 18 July 1991). But the 1991 proposed rule was not promulgated. At a December 1997 Radionuclides Stake-holders Meeting, EPA announced plans to issue final standards for all radionuclides (except for radon, which will be considered later) by November 2000 (possibly as soon as January 1999). EPA based these plans on a court agreement and its interpretation of the 1996 amendments to the Safe Drinking Water Act.

To issue final MCLs, EPA will calculate MCLs based on mortality and morbidity risk analyses that consider gender and age, and then compare the calculated MCLs to existing MCLs. If a calculated MCL is smaller than the existing MCL, then the final MCL will be the calculated MCL; if a calculated MCL is larger than the existing MCL, then the final MCL will be the existing MCL. EPA is considering risk limits of lE-4 morbidity (incidence) and a 5E-5 mortality as a general basis for analysis, and risk coefficients from Federal Guidance Report 13 (FGR13). (This report is in draft and is not now publicly available.)

The outcome of the rulemaking is difficult to predict. Nonetheless, we have used information obtained from the meeting and from EPA staff to make forecasts of final MCLs. We consider MCLs for radium, total alpha, uranium, and beta-gamma emitters.

Radium. The current MCL for radium is 5 pCi/L for combined Ra-226 and Ra-228. Using a May 1997 draft of FGR13, and assuming consumption of 2 liters of tap water per day for 70 years and the above risk limits, we calculate (in pCi/L):

Nuclide	Mortality	Incidence
Ra-226	5.4	7.4
Ra-228	1.5	2.1

EPA has not decided whether to issue a combined MCL or an MCL for each radium isotope. If a combined MCL, it will probably not be much smaller than 5 pCi/L. Measurement difficulty (for Ra-228) and the costs of water treatment will be considered.

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[1]The forecasts are simplistic, since the factors EPA is considering are more complex than those-addressed here.

Total alpha. The existing MCL for total alpha is 15 pCi/L, where Ra-226 is included but not radon and uranium isotopes. EPA staff want to eliminate the 15-pCi/L limit and issue MCLs for each alpha-emitting radionuclide, assessing mixtures of radionuclides using a sum-of-fractions calculation. Using the May 1997 draft of FGR13 and the above assumptions, calculated limits for several radionuclides are listed below (in pCi/L).

Nuclide	Mortality	Incidence	Nuclide	Mortality	Incidence
Po-210	0.75	1.1	Pu-239	9.3	15
Ra-224	9.9	12	Pu-240	9.3	14
Th-228	15	18	Pu-242	9.8	15
Th-230	16	22	AM-241	13	19
Th-232	14	19	Am-243	13	19
Np-237	24	31	Cm-242	43	51
Pu-236	18	26	Cm-243	15	21
Pu-238	9.6	15	Cm-244	17	23

If EPA sets forth MCLs for each radionuclide, then EPA might also establish a cap for radionuclides such as Cm-242 where calculated limits exceed 15 pCi/L. Such a cap might be smaller than 15 pCi/L considering that the existing 15-pCi/L limit includes Ra-226. Assuming 15 pCi/L, the final MCL for most of the above radionuclides could be 15 pCi/L, except for PO-210 (about 1 pCi/L) and Ra-224 and most plutonium isotopes (about 10 pCi/L).

Uranium. In 1991, EPA proposed MCLs of 20 ug/L or 30 pCi/L. EPA will issue final MCLs considering kidney toxicity as well as cancer' risk, and may require compliance with both a mass concentration (ug/L) and an activity concentration (pCi/L) limit. A mass concentration limit would likely be not much smaller than 20 ug/L. But an activity concentration limit might be smaller than 30 pCi/L, as suggested by the following results based on FGR13 and other assumptions as discussed above (in pCi/L):

Nuclide	Mortality	Incidence	Nuclide	Mortality	Incidence
U-232	4.8	6.7	U-235	22	28
U-233	21	27	U-236	23	29
U-234	21	28	U-238	23	31

Beta-Gamma Emitters. EPA plans to eliminate the 4-mrem (ede) limit proposed in 1991 and instead issue specific MCLs for each radionuclide. Using the above assumptions,. calculated limits for several example radionuclides are listed below along with existing MCLs (pCi/L). We have also listed those MCLs proposed in 1991 that correspond to an annual 4-mrem (ede) dose limit.

For most radionuclides the existing MCLs would be restrictive. This would not be the case, however, for radionuclides such as C-14, Tc-99, and Cs-137. Many final MCLs will correspond to annual doses that are smaller than 4 mrem (ede).

Calculations for Beta-Gamma Emitting Radionuclides (pCi/L)

Nuclide	Mortality[a]	Incidence[a]	Existing MCL[b]	Proposed MCL[c]
H-3[a]	28,000	39,000	20,000	60,900
C-14	920	1,300	2,000	3,200
Ca-45	560	790	10	1,730
Ca-47	220	250	80	846
Sc-47	500	560	300	2,440
Fe-55	1,600	2,500	2,000	9,250
Fe-59	210	260	200	844
Co-58	550	660	300	1,590
Co-60	96	120	100	218
Ni-59	6,000	7,100	300	27,000
Ni-63	2,400	2,900	50	9,910
Zn-65	120	170	300	396
Se-75	170	240	900	574
Sr-89	120	150	20	599
Sr-90	21	36	8	42
Y-90	98	110	60	510
Zr-95	370	430	200	1,460
Nb-94	220	250		707
Mo-99	850	1,200	600	1,830
Tc-99	620	710	900	3,790
Ru-103	450	510	200	1,810
Ru-106	41	46	30	203
Ag-110m	160	200	90	512
Sb-124	130	150	60	563
Sb-125	360	450	300	1,940
I-125	370	77	3	151
I-129	65	13	1	21
I-131	200	43	3	108
I-132	3,900	2,300	90	8,190
I-133	570	140	10	549
I-134	7,200	7,800	100	214
I-135	1,900	640	30	2,340
Cs-134	33	46	80	81.3
Cs-137	47	64	200	119
Pb-210	1.7	2.5		1.01
Ac-228	830	960		3,270
Pa-233	320	350	300	1,510
Th-231	800	890		4,070
Th-234	76	85		401
Pu-241	670	1,100		62.6

[a]70-year risks of 5E-5 (Mortality) and 1E-4 (Incidence).
[b]From " Radioactivity in Drinking Water," EPA 570/ 9-81-002, January 1981.
[c]MCLs based on proposed (1991) annual 4-mrem (ede) limit.
[d]as HTO.

Sum of fractions. EPA will apply a sum-of-fractions requirement to MCLs for beta-gamma emitters and for other nuclide mixtures, but not to MCLs for all nuclides (e.g., MCLs for alpha-emitters would be summed separately from MCLs for beta-gamma emitters).